LEONARDO ELECTRONICS

SIR-S/I

Integrated Mode-S Secondary Surveillance Radar

Leonardo SIR-S/I is a Mode-S Secondary Surveillance Radar is operated for detection of cooperative targets in Air Traffic Control. SIR-S/I is a modular system operating as standalone or combined with a Primary Surveillance Radar (PSR). Both configurations are full compliance with ICAO and EUROCONTROL requirements for Mode-S operations.

SIR-S/I is a dual-channel system with automatic changeover, solid-state transmitter and receiver, with an embedded ADS-B channel and tracking function, optionally available in internal or external configuration. The dual channel system is housed in a single cabinet and is designed for 24/7 unmanned operations.

SIR-S/I can be operated in Mode-S Elementary and Enhanced Surveillance in SSR conventional modes (3/A, C). An additional kit is optionally available to implement military modes, conventional (1 and 2) and secure Mode-5 (Mode-4 is also available for back compatibility, upon request). The SIR-S/I can also operate Friend or Foe (IFF) Interrogation to identify aircraft, vehicles, and air forces.

The SIR-S/I embedded ADS-B receiving channel is designed to acquire, decode, and process 1090 MHz Extended Squitter messages coming from both Omni and Sum MSSR antenna channels. It operates according to ICAO Annex 10, RTCA DO-260, RTCA DO-260A, RTCA DO-260B specifications. Mode-S allows high data integrity (by synchronous

garbling elimination and de-fruiting), unambiguous aircraft identification, improved situation awareness and safety. This is achieved on employing additional information extracted from transponder (Call-Sign, Selected Altitude, Ground Speed, Magnetic Heading, etc.) and the ADS-B channel, if available. This results in a strong reduction of interrogation rate with consequent reduction of RF pollution.

The ALE-9 LVA antenna is designed for full monopulse operation, providing high directional properties in azimuth, and large aperture in the vertical plane, as recommended by ICAO for Enhanced Mode-S Surveillance (EHS) operations. SIR-S/I Mode-S operation has been fully verified against EUROCONTROL Mode-S Functional Specifications, and is fully compatible with the latest 4.0. version.
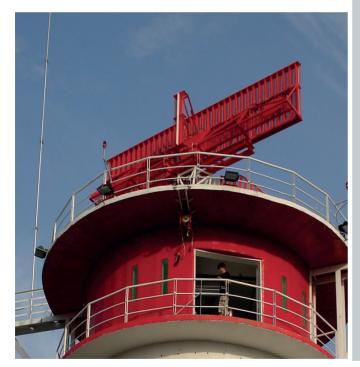
PROCESSING FEATURES

- Amplitude and Signal Processing (ASP)
- Dot Product Processing (DPP) algorithms for improved azimuth angle estimation
- Processing chain for Mode-S and ADS-B replies
- Processing chain decoding ADS-B information, including:

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- Surface and airborne position
- Aircraft status identification and type
- Airborne Velocity
- Test Messages – Mode A Code
- Target State and Status
- Aircraft Operational Status

• Mode-S/ADS-B Hybrid Surveillance for EM emission reduction
• Surveillance Coordination (Clustering) among stations
• Data-Link with aircraft (local/remote BDS request management)
• Extensive supervision via graphical interface, with on-line and off-line performance monitoring
• Extensive embedded BITE for fault detection with local/remote capabilities
• Local and Remote Control and Monitoring for real time information and data logging

ARCHITECTURE

• Latest generation of RF power transistors
• Latest generation processors
• North Alignment by test transponder replies
• Reply generation at RF level with TTG circuitry
• On-line receiver calibration
• Antenna Pattern Monitoring

TECHNICAL FEATURES

PERFORMANCES

• Range	Up to 256 NM
• Detection volume	Up to 66000 feet, 360° horizontal plane
	Up to 45° vertical plane
• Scan rate	Up to 15 RPM
• Mode-S probability of detection	> 99%
• Probability of code validation	≥ 98% (3/A) and ≥ 96% (C)
• Mode-S range accuracy	< 30m (RMS) for SSR transponder equipped aircrafts
	< 15m (RMS) for Mode-S transponder equipped aircrafts
• Mode-S azimuth accuracy	< 0.068° (RMS)
• Range/Azimuth resolution	Eurocontrol Area 1 (Pd > 98 %, Pdc > 98 %)
	Eurocontrol Area 2 (Pd > 98 %, Pdc > 90 %)
	Eurocontrol Area 3 (Pd > 60 %, Pdc > 30 %)

PHYSICAL CHARACTERISTICS

• Single cabinet	Height = 32U
	Width = 19"
	Depth = 27.56"

TX CHARACTERISTICS

• Fully solid-state (plug-in module) transmitter	
• Peak power	> 3 kW
• High TX duty cycle	66% peak -6% average
• ISLS and IISLS capabilities	Map controlled

RX CHARACTERISTICS

• Receiver with three matched LOG channels
• Automatic digital amplitude and phase matching
• RX dynamic range   > 80 dB
• RSLS
• Range-azimuth programmable STC

PROCESSING

• Multiprocessor based on Power-PC platform Linux based OS
• Capabilities Embedded ADS-B Processing
• II/SI code operation management
• Output data configurable number and data formats, independently for plot/track and service messages

RMA

• MTBFc	> 80,000 Hrs
• MTTR	< 20 min
• Availability (Ai)	> 0.9999

SSR/MODE-S SURVEILLANCE

• Target reports (plot/track) data	Asterix Cat. 1, 2, 34, 48
• Mode-S protocol data	Asterix Cat. 17, 18

ADS-B SURVEILLANCE

• Target ADS-B messages	Asterix Cat 021, Ed. 0.23, 0.26, 2.1
	Asterix Cat 010, Edition: 1.1
• CNS/ATM Service messages	Asterix Cat 023, Edition: 1.2
	Asterix CAT 247 rev. 1.2

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